Micro-g NExT FAQs

Micro-g Neutral Buoyancy Experiment Design Teams Frequently Asked Questions

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FAQs: General

1. ***Can I submit a design for more than one tool?***
   Each team may submit a proposal for only one of the five Micro-g NExT challenges.

2. ***Are we required to complete one or all of these design challenges listed for our proposal?***
   You shall select only 1 challenge, There are 5 options for you to choose from.

3. ***Can I participate in Micro-g NExT if I have a green card?***
   Micro-g NExT is currently available to U.S citizens enrolled in U.S institutions of higher learning.

4. ***Can we choose the test week dates?***
   When submitting your proposal you can indicate your preferred test week from the list of scheduled weeks. We will do our best to accommodate your preferred week, but your first choice is not necessarily guaranteed.

5. ***How many teams will NASA select to travel to Houston for a test week?***
   The number of teams is not predetermined but rather based on the quality of submitted proposals. There will be no more than 10-11 teams per test week.

6. ***Can more than one proposal be submitted from the same school?***
   Yes, more than one proposal can be submitted from the same school. However, students may only belong to a single team.

7. ***Can returning teams participate?***
   Returning teams may participate; however, teams may only have 2 returning members.

8. ***Can teams be comprised of students from multiple schools?***
   Absolutely! We encourage collaboration and interdisciplinary teams.

9. ***What expenses does NASA cover?***
   The selection of a team for this opportunity does not include a monetary award to your institution. NASA assumes responsibility for all costs involved with prototype testing in the NBL. Each team is responsible for all other costs including travel to Houston and cost of building prototype.

10. ***Where can I find information about the Neutral Buoyancy Laboratory (NBL)?***
    Information about the NBL can be found at the following link
    http://dx12.jsc.nasa.gov/site/index.shtml

11. ***Are there hardware requirements and/or standards my team should be aware testing in the NBL?***
    Requirements for hardware that will be tested in the Neutral Buoyancy Laboratory (NBL) can be accessed in the NBL Engineering and Safety Requirements document.

12. ***Do I get to dive with my team's prototype during testing in the NBL?***
    Professional NBL divers will test the tools and students will direct the divers from the Test Conductor Room of the NBL facility.

13. ***With whom will my team interface with at NASA?***
    Your team will have multiple interfaces at NASA each of which serve a different function. Your main interface will be a Micro-g NExT coordinator.

14. ***The outreach portion of my project involves development of K-12 curriculum for classroom use. Are there any suggested components I need to incorporate?***
    You may consult with a current K-12 educator on this topic. It is suggested that you consider the following:
    - All curricula are aligned to national standards.
    - Each curriculum piece provides the user with a connection between the curricula topic and microgravity, the NBL, or your prototype's potential use in space exploration via an introductory paragraph. This adds relevance to the material.
    - A curriculum incorporates the 5E model to the extent possible.
    - The curricula are written in grade level appropriate language.

15. ***How does my team's design potentially benefit space exploration?***
    As part of NASA's Journey to Mars, new tools and procedures are necessary to carry out the upcoming missions. One of those missions involved the return of samples from an asteroid. This video provides a good overview of why we test tools and procedures in the NBL.
    https://www.youtube.com/watch?v=T-3S248Lqxw

16. ***My project will employ social media. Can we coordinate social media outputs about the project with Micro-g NExT?***
    Absolutely. This can be coordinated with a Micro-g NExT coordinator. We will typically retweet teams' posts.

17. ***If selected, what is the first step?***
    Your team will be invited to attend a 1 hour orientation session with the Micro-g NExT staff. Attendance of this session is required of the faculty advisor and student team. The session is conducted online.

18. ***Who is responsible for writing the procedures that will be used to conduct test in the NBL?***
    Your team is responsible for drafting the diver procedures and coordinating with the assigned Ops Lead to finalize the procedures.

19. ***My choice for faculty advisor is not a U.S. citizen. Is he still able to work with my team?***
    Yes, he can still act as your advisor. However, he will be unable to travel to Houston for the test week. However, any person participating in the Test Week in Houston must be a US citizen.

20. ***What happens if our CAD file is larger than 20 MB?***
    Your proposal file must be smaller than 20 MB in order to be submitted to the Micro-g NExT website. This is to ensure all proposals can be reviewed properly from the same database. You may submit two separate files – a proposal and a CAD file. Each file has a size limit of 20MB.

21. ***How much time should I anticipate spending on this project?***
    Time requirements will vary from team to team. Expect to spend a large portion of your time on design, creation, and outreach. If your team is struggling with time management, please work with your faculty advisor to set a feasible timeline. The workload of this project is comparable to that of a 3 credit hour course.

22. ***Does a prototype need to be submitted with the proposal?***
    A prototype is not required to be submitted with the proposal. Though any prototyping you do will add to the quality of your proposal.

23. ***What is considered outreach?***
    Outreach is may consist of a presentation to a school group, a symposium, or other similar event. Your outreach must include a website that your team will maintain throughout the duration of the program. (Do not post your proposal to your team website). You may also incorporate a social media plan in your outreach activities.

24. ***How should outreach be documented in the proposal?***
    Include a description of activities you plan to carryout. The description should include the purpose of the activity, the intended audience, the expected number of participants, and what perceive will be the impact of the activity. It helps to have a letter of support from organizations you plan to work with in your outreach efforts. It is advised that you begin making connections now.

FAQ's: Technical

Please visit the EVA Reference Website below. It provides a reference you can use when considering your design. You will only be judged on your ability to meet the requirements outlined in the challenges. You are not required to meet the requirements outlined in the website. EVA Reference Website

1. ***Should we just assume the extreme when it comes to rock hardness and other material properties? (i.e. what rocks will be used, primarily the larger rock for chipping in the last challenge)***
   Asteroids can vary greatly in composition. Our recommendation is for teams to research different asteroid materials and select a reference material of choice. Note the reference material you choose and your rationale for choosing the material.

2. ***Is there somewhere to get more in detailed specs regarding the NBL (such as density)?***
   The NBL is filled with chlorinated water with a density of approximately 1 g/cm^3.

3. ***What will be the depth of operation in the NBL?***
   Assume a depth of 40ft. That is the maximum depth of the NBL.

4. ***What are the Tether attachment point dimensions/specs?***
   See the EVA Reference Website for tether dimensions. Note there is a 1" diameter hole for the tether to be inserted.

5. ***What is the size of an EVA glove?***
   See the EVA Reference Website for glove dimensions. You can also use a ski glove as a reference. It is approximately the same thickness as an EVA glove. Remember that when a space suit glove is pressurized its nominal position will be "hand open" and the astronaut needs to expend energy to close their hand.

6. ***What are the limitations on powered equipment? In regards to the "Rock Chip Sampling Device" can there be electronic control systems, sensors, etc?***
   Electronics can be used only to control a pneumatic or hydraulically powered tool. More details about the use of electronics will be discussed after the proposal selection is complete.
   Warning: the use of electronics in and around the NBL are looked at with extra scrutiny. Consider safety as a priority if incorporating electronics into your design.

7. ***Is the ideal operating position "standing" relative to "ground"? Or is it more likely to be like the video on the website?***
   The ideal operating position is "lying down" relative to the ground, just as in the video on the website.

8. ***For the rock chip sampling device challenge, can the tool be loaded with two hands even though the actually chipping of the rock requires only one hand?***
   Yes. The only action that needs to be one-handed is to accomplish the chipping requirement. Any other part of your operation such as: setup, assembly, translation, can be two-handed.

9. ***Should any modifications to our tool be necessary during testing, will there be access to tools or a machine shop?***
   Yes we will provide loose hand tools, screw driver, pliers, etc during testing week; but there will be limited to no access to larger machining tools (i.e. mill, lathe, etc.)

10. ***Is water pressure blasting allowed?***
    Yes, air or hydro pressure is allowed. However, it is important to remember the environment where the tool would ultimately operate. In the vacuum of space, water would flash freeze, making any type of water blasting very difficult to impossible. On the other hand, using water pressure blasting to represent a different blasting method that would work in space is legitimate.

11. ***Can you provide an image of some of the rocks I might be testing on for Challenge #5 – Rock Chip Sampler?***
    TBD. This is in work.

12. ***Can individual storage containers be connected to one another?***
    Yes. As long as there is no cross contamination between the samples, the individual containers can be connected.

13. ***For Challenge Number 1: Float Sample Grabber, what is the minimum sample volume the device should be capable of collecting?***
    The device shall be capable of obtaining a single sample with a diameter between 1" and 3".

14. ***Who would own the intellectual property rights?***
    NASA hopes to potentially utilize some of the ideas that your team puts forward in a future space mission. Therefore we ask that teams complete a "statement of rights" document. See the application Guidelines for specifics regarding this topic.
    Application Guidelines - Administrative

15. ***May we 3d print parts of the tool?***
    Yes. Though you'll want to consider the loads that your tool will see and ensure that the plastics used in the 3D printer can handle those loads.

16. ***Do I have to meet all of the requirements?***
    You will be scored based on how many requirements you meet. So you don't have to meet all of the requirements, but you will lose points depending on how many you don't meet.
17. ***Some requirements are vague. What should I do in this case?***
    Some requirements are purposely vague. We want you to do the research and provide rationale for why you designed it the way you did.

18. ***Can I use a CO_2 canister?***
    For usage in the NBL, no, you cannot use any type of pressurized canister. If your device is pneumatically powered you will be required to standard shop air from the NBL which has a maximum of 125psi.

19. ***Is our team allowed to use gun powder or nail guns?***
    They are not strictly forbidden but you will seriously need to consider safety if you choose to implement these types of designs in space. Also a critical part of this challenge is to actually be able to test your tool in the NBL. You'd have to prove to NASA without any doubt that the device is safe for the operator. In addition, you should consider the vacuum environment of space and how you would implement such a system.

20. ***Will the diver be stabilized during operation of the tool?***
    Assume that the diver is stabilized and has two hands free.

21. ***Can we have detachable parts on the prototypes, specifically Challenge 1: Float Sample Grabber?***
    Yes. You can have multiple pieces of hardware to accomplish that challenge. All pieces together should fit within the given dimensions.

22. ***Will we have to make a waterproof version of our tool?***
    You will have to make a version of your tool that operates in the NBL. We will work with you to ensure you are using approved materials.

23. ***How strict is the "one hand usage" rule?***
    All requirements are there for a reason. You will be scored based on how many requirements you are successfully able to meet. Also, the one-handed requirement refers only to performing the action of the tool: such as the act of chipping or the act of grabbing. Two hands can be used for setup or tool management.

24. ***What is expected to be below the two feet of sand/rock mixture?***
    The regolith (sand) will be in a container. So if you go down deep enough you will hit the bottom of the container. The depth of the container has not yet been determined.

25. ***How sensitive is the surface of the heat shield tiles on the Orion vehicle. Should they not be touched at all?***
    Very sensitive. They should not be touched at all.

26. ***Are we able to use magnets for any part of the challenges, just as a small component, not as a whole?***
    Yes, magnets are okay in that capacity.

27. ***For the anchoring device, is there concern about sinking into the asteroid (ex: during thruster firing)?***
    As the gravity on asteroids is really low, sinking into the asteroid is not a concern.

28. ***Are there restrictions or should there be for certain plastics that should or should not be used for the Boom?***
    See NBL Approved Materials List contained in the NBL Engineering and Safety Requirements document. You have to ensure that the plastic you choose can handle the expected loads.

29. ***Does the prototype have to be built on a 1:1 scale, or can it be smaller?***
    The simulation in the NBL will be full-scale, 1:1. However, doing scale prototypes during the proposal phase is recommended to show the validity of your design.

30. ***For the Anchoring Device, is the force continuous (static load) or is it applied for a specific interval of time?***
    The minimum requirement will be a 10 lb force applied for 15 seconds. If you can do more than 10 lbs that would be great as well.

31. ***How often can the teams ask for technical clarifications? Will all technical clarifications be posted for all teams to see?***
    All questions and their answers will be continuously posted in this FAQ document. Check this document regularly. Ask as many questions as you'd like, we'll get to them as soon as we can.

32. ***What kind of CAD program is best for all of these? Solid words or AutoCAD?***
    You can use any CAD program you'd like, or none at all. A 3D model is not required, though it is recommended as it is easier to understand a design that way.

33. ***For the Boom challenge, we are required to design a coupler for the ARV with given dimensions. What do the dimensions of the ARV coupler represent?***
    The volume requirement means that the entirety of your design must fit within that box.

34. ***For the Boom challenge, does the Boom connect to the coupler on the area of the specified cylinder in the problem statement?***
    The cylinder noted in the Boom Challenge is what will allow your Coupler to interface to our existing ARV mockup that's in the NBL. We have a receptacle and you'll need a cylinder of those dimensions to interface with that receptacle. An interface document will be made in the future to specify those requirements further.

35. ***Can you combine the functions of multiple tools together to save cargo space?***
    That's a great thought and an important consideration for space tool development. For the purpose of this Program we ask you select only 1 challenge. If it happens to accomplish more than 1 function that's great, but it will only be judged on a single function.

36. ***What type of material is used to contain the chip samples once they are captured, for transfer to the lab?***
    Please refer to the link below to see a list of materials approved for use in the NBL. NBL Requirements

37. ***Will the astronauts be using labeled bags or can the design have its own collection component?***
    Your team is responsible for design a device that creates, captures, and contains the chips, while preventing cross contamination. So you are responsible for the collection component. Labeling the containers is definitely recommended.

38. ***For the Boom challenge, the problem requires the boom to have a tether attachment point. Is this for the astronauts to be tethered to the boom, or to tether it to the Orion Vehicle so it is secured at both ends?***
    It will be used for both purposes. All tools used in microgravity need to be tethered. So the astronaut will tether to the Boom prior to deploying it. Additionally, a tether will be used to secure one end of the boom to the Orion vehicle. The other of end of the boom gets secured to your custom designed ARV Coupler.

39. ***Could you further elaborate on the materials used to simulate a regolith for the anchoring device?***
    Sand from a local hardware store will be used as regolith simulant.

40. ***Do you have a document that lists the materials we can use to construct our tools?***
    Please refer to the link below to see a list of materials approved for use in the NBL. NBL Requirements

41. ***Who provides the regolith materials?***
    NASA provides all the testing materials. You are only responsible for providing your tool.

42. ***Is there any design requirement for the tether device in the boom challenge?***
    NASA will provide tethers for you to use. You need to ensure your device has a tether point 1" in diameter. You can search images "NASA equipment tether" on the internet to see examples of tethers.

43. ***Will we be able to test pneumatic devices in the underwater testing environment?***
    Yes, pneumatics are allowed. Though the extra scrutiny will be put on the safety aspects of using these hardware. See NBL Requirements.

44. ***What is the ideal core size dimensions?***
    Please refer to the Challenge Requirements.

45. ***What is the regolith anchor meant to ultimately be used for? To anchor tools or to serve as a proof of concept for an astronaut (~130 kg) or space vehicle (~15,000 kg) anchor?***
    Anchoring techniques will be needed to anchor tools, instruments, and other small equipment (i.e. hoppers) to an asteroid. Additionally, anchoring will be necessary to anchor larger masses such as an astronaut (~130 kg) or space vehicle (~15,000 kg) to the surface. We leave it up to the teams to decide which anchoring technique to pursue, but we encourage them to focus on either the large scale or small scale.

46. ***How large is the asteroid that the regolith anchor is planned to be used on? Itokawa-sized or something that can be captured and moved into lunar orbit in the near future.***
    Anchoring techniques will be needed for asteroids ranging from the meter to kilometer scale. For the purposes of this challenge, the focus is on anchoring to asteroids and boulders ranging from 1 meter to 500 meters. We leave it up to the teams to decide which end of the 1-500 meter range to focus on.